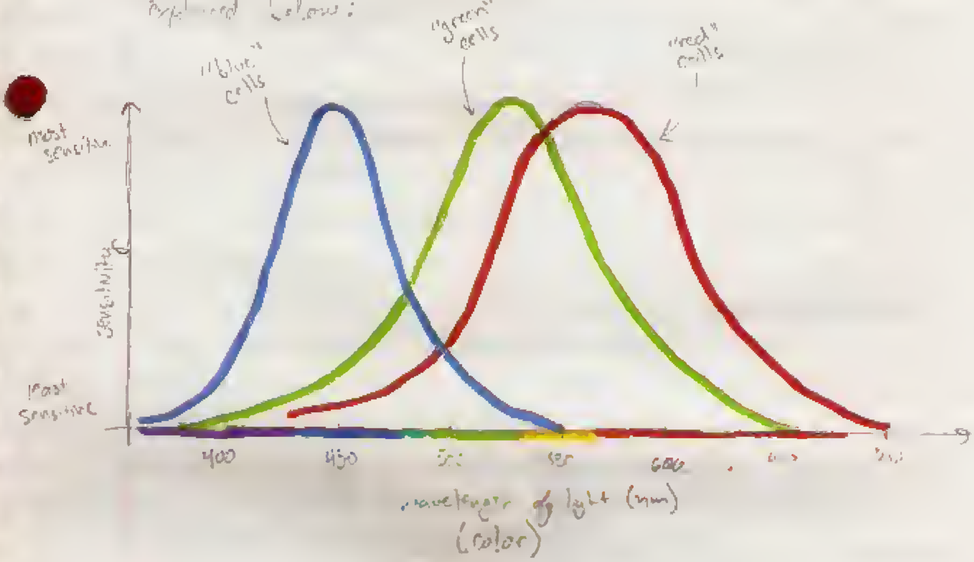
Subtractive Colors

Red-Yellow-Blue Primary Colors

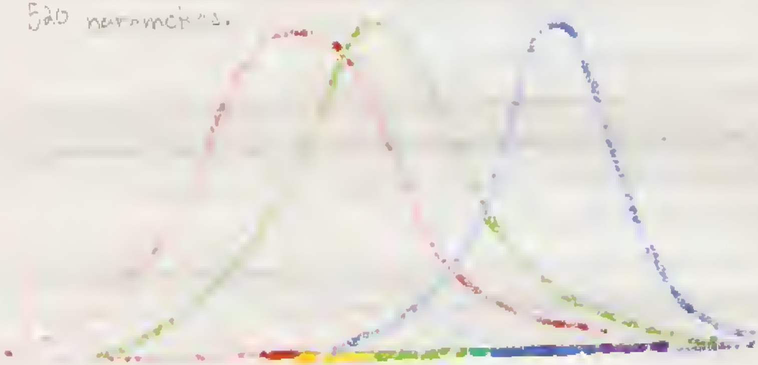
Human vision is called tri<u>chromatic</u>, meaning it can see 3 colors, sort of. What it really means is that there are 3 different types of light-sensitive cells in the back of the eye. Each of these different types is most sensitive to a different wavelength (color) of light. These different types are usually called red, green, & blue which [very] approximately indicates the color they are most sensitive to. A graph of the sensitivity of each type to different wavelengths is shown here, & explained below:



The horizontal axis shows different wavelengths of light. The color of light is dependent on its wavelength, as shown by the rainbow spectrum on the line. For instance, light with 450 nanometer wavelength is blue, & 550 nanometer light is yellow.

On the graph, each of the [illegible] different types of eye cells [illegible] a different curve, [illegible] different [illegible]. The height of the curve at each wavelength [illegible] [illegible] that type of cell [illegible]. For instance, the [illegible] type of cell is most [illegible] (has its peak in the curve, at about [illegible] nanometers, [illegible] [illegible] blue [illegible] purple), [illegible] sensitive to a range of other wavelengths [illegible] a bit less than [illegible] nanometers [illegible] 550 nanometers, its just not as [illegible] [illegible] 440 nanometer light.

Likewise, the red type of cells are most sensitive at around 560 nanometers, & the green type is most sensitive at about 520 nanometers.



[illegible] different curves overlap. [illegible] [illegible] certain wavelengths, more than one type of cell is sensitive. Take yellow light [illegible] [illegible] can see on the graph at about 550 nanometers, the "red" & "green" type of cells have about the same [illegible], but the [illegible] type [illegible] [illegible] yellow light reaches your eye, [illegible] "red" & "green" types of cells [illegible] send

signals to the brain, & since they both have about the same sensitivity to this wavelength of light (yellow), the strength of the signals is about the same from each type of cell. Since the blue type of cell has almost no sensitivity to this color of light, it will send a very weak signal (if any) to the brain. It's the combination of signals from the different types of cells that tell the brain [illegible] yellow.

Looking back at the graph, you can see that as you start sliding towards orange (towards the right from yellow), the "green" cells' sensitivity drops, & the "red" cells' increases slightly. That means it will be a different pattern of signals going to the brain: strong from "red" cells, a little weaker from "green" cells, & [illegible] from "blue" cells. The combination of signals indicates orange to the brain.

That's why red, green, & blue are used as primary colors when combining lights. For instance, if you have a red light and a green light of equal brightness [illegible], they [illegible] trigger strong signals from the "red" & "green" [illegible] from the "blue", so it [illegible] look the same to your brain as yellow light does. Then, if you decrease the brightness of the green [illegible] & increase the brightness of the red light, it will change the signals in the same way so that it looks orange to your brain.
In this way, you can "trick" your brain into thinking there [illegible] any color by combining different levels of red, green, & blue light in order to trigger the same pattern of signals from the three types of cells as actual light of that color would.

Combining colors of [illegible] additive color [illegible] because you're mixing different [illegible] together to make

different colors. However, when you mix opaque things, like paint, it is called subtractive color mixing because each color removes certain wavelengths of light.

For instance, red paint absorbs all wavelengths of light except those around 600 nanometers (red light), which are reflected back, & that's why it looks red.

For yellow paint to look yellow, the light that reflects off of it must trigger the same sensitivity in both the "red" & "green" types of cells but minimal or no sensitivity in the "blue" type. In other words, yellow paint looks yellow because it absorbs light with small wavelengths (blue & purple) & reflects the rest.

Blue paint on the other hand looks blue because it only reflects wavelengths that the "blue" cells are sensitive to while absorbing light that the "red" cells are sensitive to.

So if you mix yellow paint & blue paint, the yellow paint will block (absorb) the wavelengths that the "blue" cells are sensitive to, & the blue paint will block the wavelengths that the "red" cells [illegible] the only [illegible] wavelengths (that are not absorbed but are instead reflected back at the eye) are those that the "green" cells are sensitive to, hence yellow & blue paint mixed together look green.